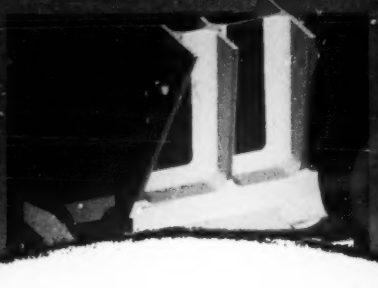
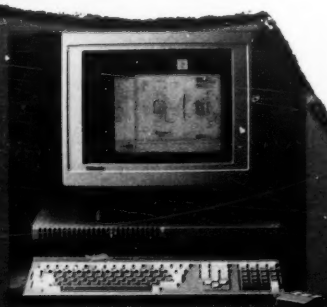
JANUARY 1990

# PRODUCTION

THE MAGAZINE OF MANUFACTURING MANAGEMENT



## Do I Really Need CIM?



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# PRODUCTION

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# Cleaning Up

***International pressures—as well as those stemming from our own government and private agencies—concerning the environment are forcing makers and users of CFCs to rethink their use and invent their replacement. A year after the protocol banning CFC use, here's an update.***

***By Robin P. Bergstrom***
*Senior Features Editor*

CHLOROFLUOROCARBONS (CFCs) ARE burning holes in the ozone layer. It's true.

But, you say, CFCs—aren't those the things that were in those fast-food containers and aerosol cans, things that we did away with several years ago along about the time that some environmentalists or scientists looked up and said, "Something's burning holes in the ozone layer."

Yes, and at the time a lot of people looked skyward, didn't see any holes, and didn't believe it.

At the time a lot of people didn't know what ozone was, let alone chlorofluorocarbons.

And now they're back—actually never went away.

**A little background.** There's little doubt that CFCs have been of significant benefit to industry and consumers—the price paid by the environment notwithstanding—since their development and introduction in the 1930s. They virtually touch much of everyday life—as coolants in air conditioners and refrigerators, as blowing agents in foam insulation, as solvents for cleaning electronics and metals, and as sterilizers for medical devices. Taken together the varied uses of CFCs represent a $28 billion industry, and the fact is that many things we take for granted today—from a safe and varied food supply to efficient global communications to energy efficient homes and cars—would quite simply be impossible were it not for CFCs.

However, while the upside of CFCs seemed pretty well understood, by the mid-1970s two professors from the University of California at Irvine put forward the theory that CFCs might just cause long-term harm to the stratospheric ozone layer.

The theory was this: that CFCs are highly stable compounds which remain intact when they are released into the air, breaking apart only when they reach the stratosphere. There they release chlorine, which destroys ozone molecules that serve as the earth's natural barrier to harmful ultraviolet radiation. Thus the holes, thus the problem.

And a decade and a half later, the theory has been pretty much proven to be the reality.

What's going on now is that under an international agreement, called the United Nations Environment Program (UNEP) protocol, which was signed in Montreal in 1987, most of the nations that manufacture CFCs are required to reduce their production to 50 percent of 1986 levels. This must be done by July 1998. The protocol went into effect a year ago, and since that time, several new aspects have surfaced which may lead to a complete phaseout of CFCs by as early as 1995.

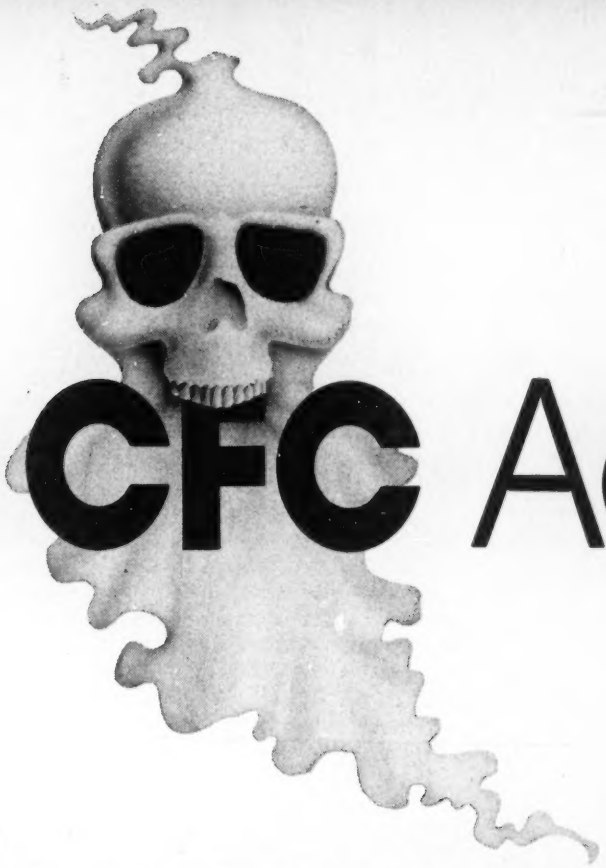
**What happened when:** 1974: Sherwood Rowland and Mario Molina of University of California, Irvine, put forward the theory that CFCs might be doing serious harm to the stratospheric ozone layer.

Late 1970s: U.S., Canada, and Scandinavia ban use of CFCs as aerosol propellants. Intensive research begins on CFCs and ozone depletion.

March 1985: UN Environmental Programme's (UNEP) Vienna Convention for the Protection of the Ozone Layer produces a treaty calling for international cooperation to further research and, if necessary, to regulate CFC production.

May 1985: British Antarctic Survey Team announces the discovery of a seasonal thinning of the ozone layer over the South Pole.

September 1987: Scientific expedition confirms that CFCs contributed to the Antarctic ozone depletion.



# the CFC Act

September 1987: UNEP adopts the "Montreal Protocol on Substances that Deplete the Ozone Layer," requiring signatory nations to reduce CFC production in three stages. It is significant to note here that China did not sign the Protocol—significant in that China plans to build eight CFC plants during the next 10 years to meet its national goal of providing refrigerators for all its citizens. If viable substitutes for CFCs are not available, the Chinese will probably opt to use CFCs no matter what the environmental consequences.

March 1988: Report from the "Ozone Trends Panel" says that ozone depletion is more severe than previously thought and occurs over more heavily populated portions of the globe. Many countries, including the U.S. and the European Economic Community, call for an outright ban on CFCs by the end of the century.

August 1988: U.S. EPA adopts the provisions of the Montreal Protocol as a domestic regulation.

April 1989: A first meeting of the Montreal Protocol Parties, 80 nations agree to tighten timetable established by the Montreal Protocol. They propose that all substances covered by the Protocol be phased out by the year 2000. This non-binding agreement is known as the Helsinki Declaration.

April 1990: The Montreal Protocol Parties will meet to vote on any proposed changes to the Protocol.

**Who's doing what?** Du Pont Co. (Wilmington, DE) recently announced the development of a product for cleaning metal that performs better than CFC 113—and is safer. An azeotrope-like blend of hydrochlorofluorocarbons (HCFC) 123 and 141b, the product removes grease and water soluble oil residues from common metals and is more compatible with aluminum parts.

"The improved performance of this blend, combined with the fact that it has 94 percent less ozone depletion potential, will provide customers with an excellent choice as we continue to develop a family of alternative cleaning agents," said Ling-Yee Gibney, cleaning agents market manager, "Freon" Products Div. "We have tried to capture and improve on all the performance benefits of our CFC products, while minimizing environmental and compatibility concerns."

**Fluorocarbon: End Use Markets 1986**

| Markets | Usage (Millions Of Lbs) | % Of Total |
|---|---|---|
| Refrigeration & air conditioning | 414 | 39 |
| Foam blowing agents | 180 | 17 |
| Solvents | 148 | 14 |
| Fluoropolymers | 148 | 14 |
| Others | 170 | 16 |
| Total | 1,060 | 100% |

Source: B.I. DuPont de Nemours

The HCFC-123/141b blend is available in limited quantities for customer evaluation. Commercial quantities of the product could become available in the early 1990s pending favorable toxicology, process development, and market and regulatory acceptance. The blend is the latest development in Du Pont's effort to introduce environmentally acceptable alternatives to fully halogenated CFCs.

Last year the company introduced "Freon" SMT and "Freon" MCA, two interim cleaning agents with 25 and 37 percent less ozone depletion potential than CFC-113, respectively. In March of 1989 Du Pont announced two long-term cleaning agent candidates to replace CFC-113. The first, a blend of HCFCs 123, 141b and methanol, has 90 percent less ozone depletion potential than CFC-113 and the second, a hydrocarbon-based product, has no ozone depletion potential.

Dow Chemical Co. (Midland, MI) recently announced the commercialization of a reduced CFC insulation system with Trailmobile, Inc., a leading manufacturer of refrigerated van trailers.

This technological development is part of Dow's effort to assist customers in complying with EPA rules restricting the use of fully halogenated CFCs. The EPA rules require that 1989 production and consumption of CFC-11, -12, -113, -114, and -115 be reduced to 1986 levels with additional cutbacks to be instituted in 1993 and 1998.

Trailmobile uses a two-part polyurethane rigid foam system containing VORANOL® plyether polyol and PAPI® polymeric MDI in its refrigerated vans and insulated dry vans. CFC-11 is used as a blowing agent to expand the liquid polyurethane into a solid foam material. CFC reduction was accomplished by co-blowing with $CO_2$ and modification of the polyol component of the Dow system.

Further, Dow will soon begin making STYROFOAM® brand insulation next year using non-fully halogenated CFCs currently used in the manufacturing process. According to Dow, this will be a global program, with the timing of each country depending on the available supply of these alternative CFC materials and any other local testing and approval as required. In the U.S., this work began last year.

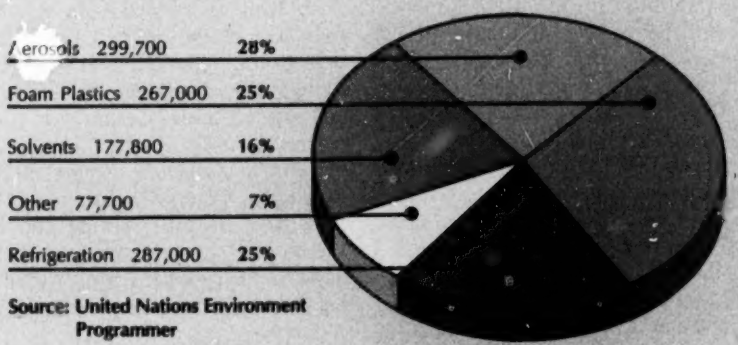
Allied-Signal (Morris Township, NJ) recently announced plans to build the world's first commercial plant to manufacture HCFC 141b, a key substitute for CFCs.

HCFC 141b will substitute for CFC 11 as a blowing agent in urethane foams and will replace CFC 113 in a broad range of solvents. The new product reduces by 90 to 95 percent the ozone depletion caused by materials now in use.

Constrution of the $50 million facility will begin next spring with shipments expected in late 1991. The facility will be easily expandable to meet future market demand. The annual U.S. market for CFC 11 used as a blowing agent is about 200 million pounds. The market for CFC 113 as a solvent is about 165 million pounds.

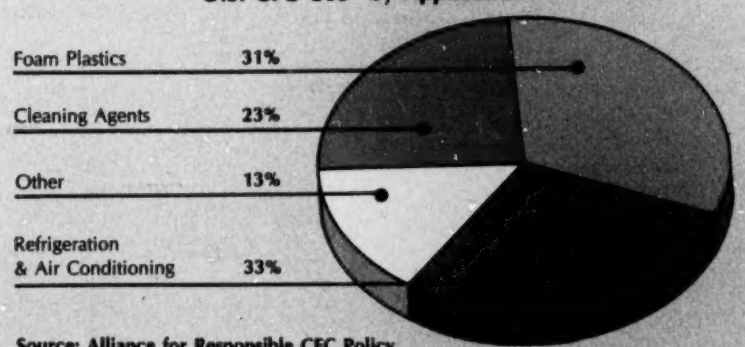
"The solution to ozone depletion is the availability of substitutes for CFCs," said Frederic M. Poses, president of Allied-Signal's Engineered Materials Sector. "Commercial availability of HCFC 141b will be a major step away from CFCs that have been implicated in damaging the earth's ozone layer. Because of the applications in which 141b is used it is expected to replace ozone-depleting CFCs very rapidly. The U.S. needs this product available to meet its obligations under the Montreal Protocol." P

**1988 Global CFC Use—by Application (in metric tons)**




Source: United Nations Environment Programmer

**U.S. CFC Use—by Application**




Source: Alliance for Responsible CFC Policy